Large Ion Pump Parameters

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Diode vs Triode

Specification for Diode Ion Pumps

Features and Options

Procurement Strategy

Why not triode

Pros

- S_{Ar} < 20% of S_{N2} , No Ar instability w/ air leaks

  (S_{Ar} ~1 % of S_{N2} for diode)

- High S at high P (e.g. > 10^{-6} Torr near SNS windows)

Cons

- Lower S per volume for N_2, H_2 (more gaps for HV)
- Lower S at lower P due to smaller cells
- Higher leakage current (>> uA) due to cathode field emission and coating of cathode insulators
- HV shorts, H_2 thermal runaway (thinner cathodes)
- Harder to rebuild, two vendors (3-4 vendors for diode)

Specification for Large Diode SIP

Physical

- 8” CF (ESR or VAR) NR, bolt clearance from pump side?
- mini-CF for feedthrough w/ removable protective shroud

  0 – 50C, 80% RH, radiation compatible, type (Fisher, Kings…?)
- lifting lugs (2 at 8” CF side), support bosses (number & locations?)
- outer dimensions: < 16” x 18” x 14” , ~ 150 lb, supportable by CF
- material: 304L, 316L for pump body, anodes, sputtering shields…

  Ti: ASTM B265 Grade 2 Ta: ASTM B708

  Minimum cell ID(5/8”) Cathode thickness (> 0.06”)
- removable magnets, bakeable paint, rebuildable elements

Specification *(conti.)*

Performance after saturation (10 Torr.l N_2)

- +5 kV; Pressure range: $5x10^{-4}$ to 10^{-10} Torr (e.g. P_{min} ~ $1x10^{-10}$ Torr)
- S_{N2} >= 250 l/s at $1x10^{-7}$ Torr, 90% at $1x10^{-8}$, 75% at $1x10^{-9}$
- S_{H2} > 90% S_{N2}, S_{Ar} > 1% S_{N2} (diode), S_{Ar} > 5% S_{N2} (noble diode)
- Lifetime = $1x10^{-6}$ Torr x 50,000 hrs
- S at lifetime (> 80% of So)
- Bakeable to 300 C x 24 hr x 50, 450 C x 24 hr x 10 (w/o magnets)
- B > 1 kG, type of magnets? B_{fringe} < 5 gauss at 8" CF
- Leakage current < 10 nA (new), < 100 nA (saturation) at 5 kV
- Pump body leak rate < $1x10^{-11}$ atm.cc/sec

Features & Options

Recommended features

- Noble diodes (Ti + Ta cathodes) for 50% SIP (+$500 ea.)
- Imbedded heaters for 50% SIP (+$1000 ea.), inlet screen
- Radiation hardened/bakeable cables (leakage < 1 nA, 10^9 rads?)
  length (~ 6 m?), ~$300 ea., mating connector
- Multi-year warranty (or effective after installation?)

Other options

- Additional elements, 5% ~ $700 ea., additional feedthroughs, ~$400 ea.

  Additional cathode plates

Procurement Strategy

Ring SIP Procurement Schedule

- Prepare specification and SOW for 74 SIPs in FY01
  - » who? approved by?
- RFQ and PO by Q3 of FY01 (approved by…)
  - » Options to buy more for ring (one per halfcell ⟹ + 16)?
  - » Options to buy more for other machine regions
  - » Who handles PO if combined procurement (account split…)
- Prototype testing in FYO2 by BNL or ORNL?
  - » S vs P at Saturation (ISO/DIS 3556-1.2?)
- Delivery in FY02 & FY03 to ORNL (?)
  - » Acceptance test by ? (procedures, % to be tested)
- Similar strategies for ion pump controllers, vacuum gauges, RGAs in FY02?

Diode and triode schematically